

Lesson 2

It's the Old Style

Landfill

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**Support
Document**

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Landfill

Support Document

Preparing materials for making the landfill.

Materials Needed

14	2L plastic soda bottles Remove the labels.
1	Scissors or X-Acto knife
1	Pair nylon hose
1	Marker
14	Cotton balls
7	Cups shredded paper
14	Cups soil
7	Rubber bands
7	Cups water
1	Measuring cup
7	Reusable grocery bags
28	One gallon Zip-Lock bags

For a class size of 30, prepare kits for 7 landfill columns.

The class will be divided into 6 groups of 5.

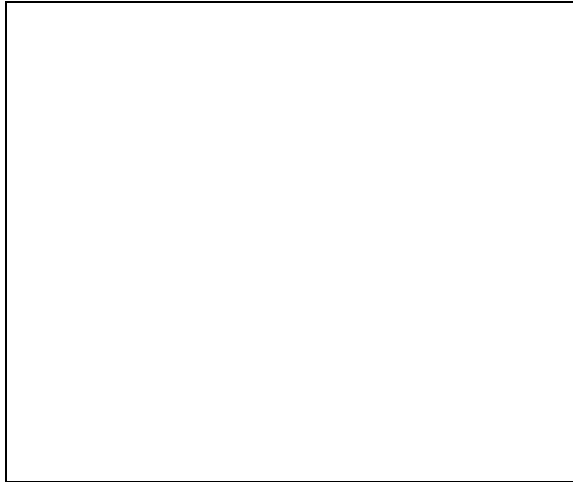
The 7th landfill will be made by the teacher (as a demonstration).

Preparing the plastic soda bottles for the landfill model

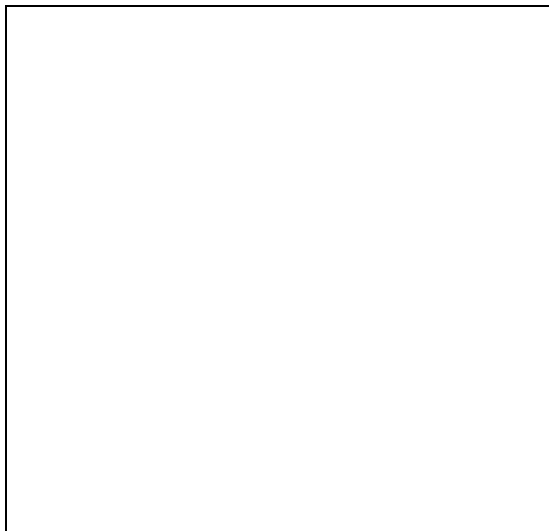
Pre-class Prep:

Bottle #1 Prep

1. Mark just below the taper where the bottom cut will be made.

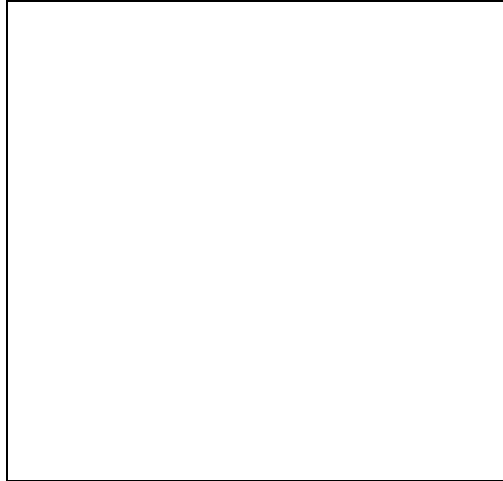


2. Use the scissors or X-Acto knife to cut the bottom off of the first bottle.
3. Write #1 on the finished product.

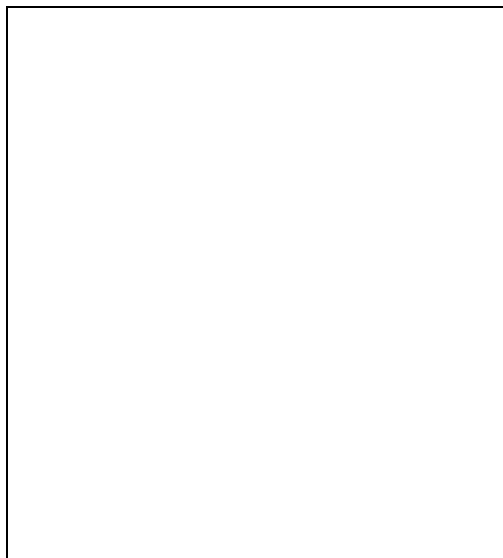


Bottle #2 Prep

4. Mark slightly above the midpoint where the bottom cut will be made.



5. With the scissors or X-Acto knife, cut the bottom off.
6. Write #2 on the finished product.

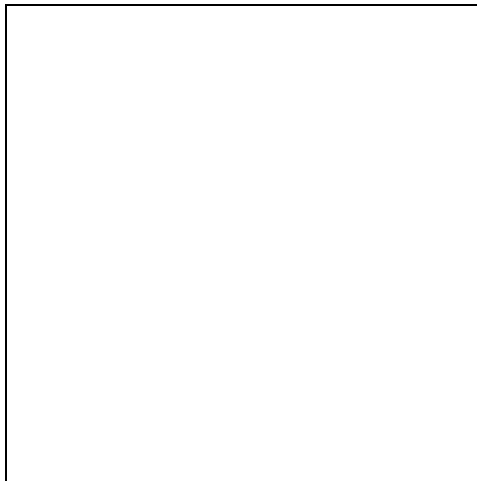


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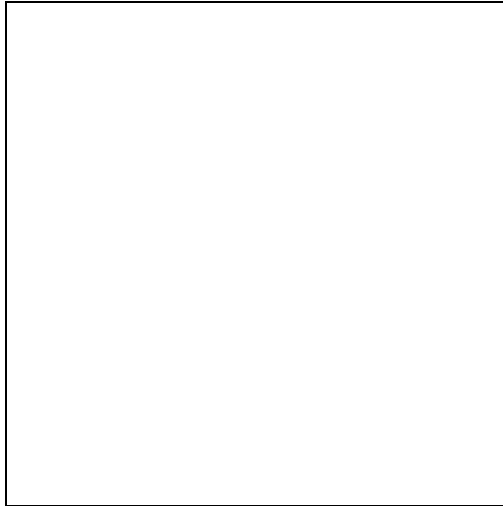
7. Cut the nylon hose into 2" squares.



8. Place 2 cotton balls into the neck of bottle #2.
9. Using the rubber bands, attach the nylon squares to the neck of bottle #2.



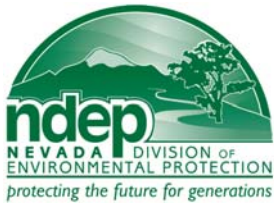
10. Assemble the two plastic bottles into the shape of a column.



Prepare the contents of the landfill column

11. Measure 1 cup of shredded paper into each of 7 Zip-Lock bags.
12. Measure 1 cup of water into each of 7 Zip-Lock bags.
13. Measure 1 cup of soil into each of 14 Zip-Lock bags.

14. Prepare the individual kits by placing the following items in each reusable grocery bag:
- 1 Landfill column
 - 1 Bag of shredded paper
 - 1 Bag of water
 - 2 Bags of soil



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Lesson 2

Teaching Strategies

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Teaching Strategies

Lecture

This strategy is effective for all levels of learners.

During the lecture, an alternative may be to use the overhead (use student worksheet as a transparency)

Worksheets

Worksheets are provided to guide the students through the lesson. The lead teacher may prefer to have the students to take their own notes.

For below level learners and special education students, the teacher may consider having the worksheets filled out for these students. This would be done before class by the teacher or by having an advanced student help.

Group Makeup

Groups should be selected by the lead classroom teacher. The groups should be heterogeneous and learners of all levels should be included.

Group Discovery

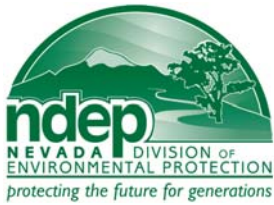
The group work is effective for all levels of learners

Homework questions

Most elementary classrooms have a computer class scheduled as a "special". If you provide the [Recycle City](#) link to the computer teacher, class time may be allotted for internet use.

Handouts of printed copies of the Recycle City information contain the same information as the website. If internet use is not available, please use the printouts.

Tip: The student worksheet can be made as a transparency for group discussion.



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Lesson 2 Part 1

Lesson Time:
30 minutes

Vocabulary

Municipal Solid Waste

Landfill

Transfer station

Per capita

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Landfill

10 lbs.

The average weight of MSW the average Nevadan disposes of each day.

Nevada Division of Environmental Protection. (2007). *State of Nevada Solid Waste Management Plan 2007*. Retrieved May 28, 2008 from <http://ndep.nv.gov/bwm/swmp/swp06.htm#sec2.5>

Objective

Students will understand the “path” waste takes from consumer to landfill.
Students will be able to apply mathematical calculations to determine the amount of waste we produce.

Materials Needed

30	Single subject notebooks (student's)
6	Dry erase markers
1	White board

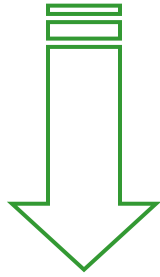
Anticipatory Set

Write the lesson objectives on the white board.
Discuss with the students what the objectives of the lessons are.

Objective: You will understand the path of waste from consumer to landfill.

Objective: You will be able to apply mathematical calculations to determine the amount of waste we produce.

Distribute handouts (or workbooks).



Introduction:

So, I was thinking about the things we throw away...then how they end up in a landfill.

Today at lunch (breakfast) what did you throw away? What went in the can?

Modeling / Guided Practice

1. Discuss what was thrown away during lunch (breakfast).
Include the types of trash and the types of packaging.
2. Ask some leading questions:
What happens to the trash after it goes in the garbage?
Who moves it?
How does it get in the garbage truck?
Where does the garbage truck take it?
Where does it ultimately end up?
3. Have a group discussion to answer the previous questions.
4. List the correct answers on the board. (see support documents)
5. Have the students write the statements in their notebooks.
6. Define MSW, landfill, transfer station, and per capita. (see support documents)

Modeling / Guided Practice

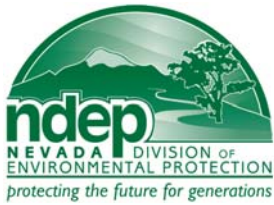
7. Discuss the amount of trash produced in Nevada per capita. (see support documents)
8. Calculate approximate weight of trash produced by:
 - Class
 - Reno
 - Sparks
9. Calculate approximate weight of trash produced per:
 - Day
 - Week
 - Month
 - Year

Closure:

1. Ask if the students understand how municipal solid waste “flows” from consumer to landfill.
2. Ask the students if they see any adverse impact on the environment. Use the think-pair-share strategy.

Independent Practice

1. Not applicable for this lesson. This flows into part 2 of lesson.



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Lesson 2 Part 2

Lesson Time:
30 minutes

Vocabulary

Leachate

Vector

Groundwater

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Lockwood Regional Landfill

Lockwood is Nevada's second largest active landfill. It is located just east of the city of Sparks in Storey County.

Objective

Students will understand the basic structure of a landfill.
Students will construct a model landfill.

Materials Needed

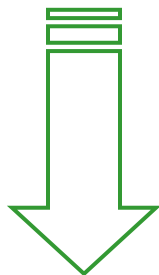
30	Single subject notebooks (student's)
6	Dry erase markers
1	White board
7	Landfill columns
7	Pre-filled kits in reusable grocery bags

Anticipatory Set

Write the lesson objectives on the white board.
Discuss with the objectives of the lesson.

Objective: You will understand the basic structure of a landfill.

Objective: You will construct a model landfill.



Introduction:

“So, we have followed the path of our trash (MSW) from the lunch room to the landfill. Now let’s take a look at the structure of a landfill.”

Modeling / Guided Practice

1. On the white board, draw the layers of the landfill (see support documents)
2. Have the students copy the landfill structure in their notebook.
3. Have the students assemble into their preselected groups of 5.
4. Pass out the prefilled reusable grocery bags.

Assemble the model landfill


5. Assemble the bottom of bottle #1 with the top of bottle #2 to form the structure of the landfill.
This is to show the students how the model will fit together.
6. Add 1 cup of soil to the model.
This represents the ground.
7. Have the students do the same.
8. Add shredded paper to the model.
This represents the MSW.
9. Have the students do the same.
10. Add 1 cup of soil to the model.
This represents the daily cover.
11. Have the students do the same.
12. Discuss the reasons for daily landfill cover. (see support documents)
13. Pour water into the landfill model.
14. Have the students do the same.
15. Discuss how the water can flow through the landfill.
16. Define leachate. Connect leachate with the flow of water through the landfill.
17. Discuss and define the vocabulary words.

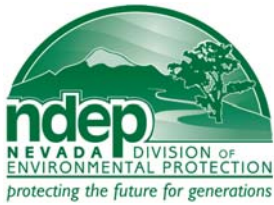


Closure:

1. Ask if the students understand how the landfill was made.
2. Ask if they understood the purpose of the lesson.

Independent Practice

1. Remind the students that part of the worksheet contains an assignment to be done outside of class.
- 



Solid Waste & Recycling Curriculum

Lesson 2

Support Document

VOCABULARY

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Vocabulary

Municipal Solid Waste: Trash (or garbage) generated by people and industry.

Landfill: A place where our MSW is buried. There are many different types of landfills, but they all bury trash.

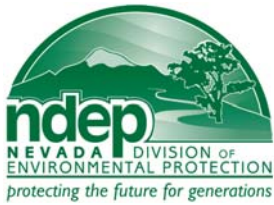
Transfer Station: A place where Municipal Solid Waste is collected prior to the waste going to a landfill. The city collection trucks bring the waste here to unload. The MSW is then reloaded onto a larger truck and sent to a landfill.

Per capita: Per person.

Leachate: The toxic liquid that seeps from the trash in a landfill. It is a potential groundwater contaminant.

Vector: Any animal or pest attracted to the garbage in landfills and spread disease.

Groundwater: The water that is under the ground. This water is commonly used as a drinking water source. It is important in this context due to the possible contamination by leachate.



Support Document

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Landfill

Leading questions...

The answers to the discussion questions should be directed to the following "flow" of MSW:

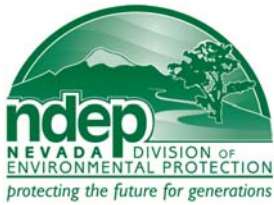
Lunchroom

Dumpster in
parking lot

Trash Truck

Transfer Station

Landfill



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The estimated amount of waste ending up in a landfill is 8 pounds per person, per day. This estimate is for Nevada and is above the national average of 4.5 pounds per person, per day.

Individual (1 person) * waste (8 lbs) = 8 lbs/person

Class size (30 people) * waste (8 lbs) = 240 lbs/class

Reno (206,735 people) * waste (7.2 lbs) = 1,653,880 lbs/Reno

Sparks (85,618 people) * waste (7.2 lbs) = 684,944 lbs/Sparks

1,653,880	lbs/Reno
+ 684,944	lbs/Sparks
<hr/>	
2,338,824	lbs/Reno+Sparks

Support Document

Use the value for waste produced in Reno for:

1 Day: $1,653,880 \text{ lbs} * 1 \text{ day} = 1,653,880 \text{ lbs}$

1 Week: $1,653,880 \text{ lbs} * 7 \text{ days} = 11,577,160 \text{ lbs}$

1 Month (30 days): $1,653,880 \text{ lbs} * 30 \text{ days} = 49,616,400 \text{ lbs}$

1 Year: $1,653,880 \text{ lbs} * 365 \text{ days} = 603,666,200 \text{ lbs}$

Data based on:

**Nevada Division of Environmental Protection's Solid Waste Management Plan 2005
and projected census data from 2005.**

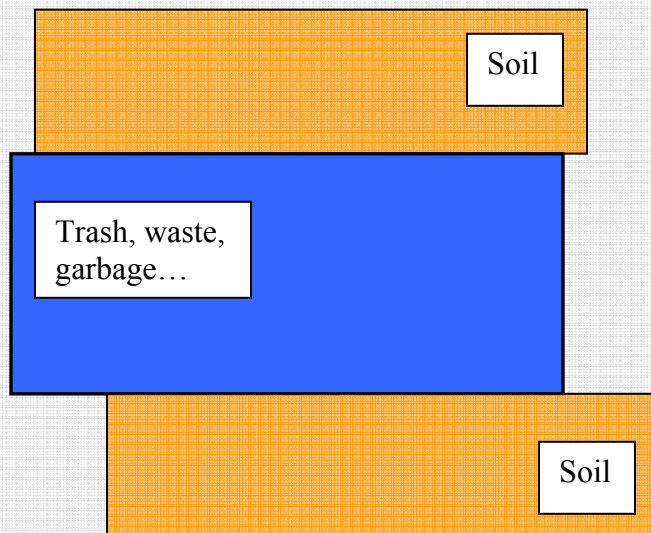
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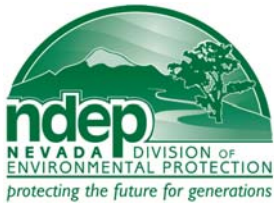
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Layers of the Old Style Landfill





Support Document

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Reasons for daily cover:

Odor control

Fire Control

Vector control

Daily cover consists of 6 inches of dirt.

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Issues concerning water flow through a landfill:

When water (moisture) flows through a landfill, it picks up the toxic substances found in the waste. Water causes the leachate to flow down through the landfill and may contaminate the groundwater.

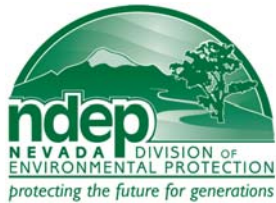
Contaminated groundwater can disrupt the ecosystem by poisoning plants and other wildlife.

By pouring the water into the model landfill, we are demonstrating this concept.

It is important to note that the amount of water in relation to such a the model is extreme. We would not expect to see such a high volume of water to flow through the landfill all at one time. Water does accumulate in the landfills, and over time, this effect may occur.

In Nevada, many of the municipal solid waste landfills are constructed this way.

The waste management companies claim there is a natural protective layer of clay beneath the landfills that prevents leachate from getting into the groundwater.



Support Document

Homework Key

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Homework – KEY

On a computer that has access to the internet, please visit <http://www.epa.gov/recyclecity/mainmap.htm>. Find the landfill within the city. Use the information you gather to answer the following questions.

1. When Recycle City was called Dumptown, the Old Landfill was used. What was put in the landfill?

Answer: Everything. All waste was put in the same “hole” in the ground.

2. What happened when poisonous liquids (caused by the trash) seeped into the soil?

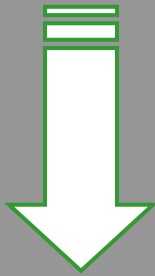
Answer: The groundwater became contaminated.

3. When Dumptown became Recycle City, how did the government fix the groundwater problem?

Answer: They built a “Pump-and-Treat” plant to filter and purify the water.

4. When Recycle City set up its New Landfill, they also set up a Materials Recovery Facility. What does this facility do?

Answer: A Materials Recovery Facility removes the reusable and recyclable materials from the trash. In addition to promoting recycling, it reduces the amount of waste that ends up in the landfill.



5. Besides the reduction of waste, what is the biggest difference between the Old Landfill and the New Landfill?

Answer: The use of a liner system to prevent contaminated water (leachate) from seeping into the earth and groundwater.

6. Please describe each of the five layers in a landfill liner.

Answer:

Layer 1 – the bottom is composed of at least two feet of clay.

Layer 2 – a sheet of strong, flexible, thick plastic is placed over the clay.

Layer 3 – gravel that contains pipes to collect leachate.

Layer 4 – geotextile fabric to protect the pipes.

Layer 5 – soil is placed on top to protect the liner from the waste.

7. Is the model landfill that we made in class more like the Recycle City Old Landfill or like the New Landfill?

Answer: Old

8. Which landfill is better for the environment? Why?

Answer: The New Landfill is better for the environment. The structure calls for a liner system that keeps the hazardous materials from touching the earth. The liner also keeps the leachate from entering the groundwater that may be used for human consumption. The landfill contains less waste because reusable and recyclable materials have been removed.

Objectives: I will understand the “path” waste takes from consumer to landfill.
I will be able to apply mathematical calculations to determine the amount of waste we produce.
I will understand the basic structure of a landfill.
I will construct a model landfill.

Vocabulary:

Municipal Solid Waste:

Landfill:

Transfer Station:

Per Capita:

Leachate:

Vector:

Groundwater:

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The Calculations:

How much trash is produced in Nevada per capita each day? _____

How many students are in this class? _____

How many people are in Reno? _____

How many people are in Sparks? _____

Please calculate the waste produced by the students in this class each day.

Please calculate the waste produced by the people in Reno each day.

Please calculate the waste produced by the people in Sparks each day.

Please calculate the waste produced by the people in Reno-Sparks each day.

Please calculate the waste produced by the people in Reno-Sparks each week.

Please calculate the waste produced by the people in Reno-Sparks each month

Please calculate the waste produced by the people in Reno-Sparks each year.

Do you think there are adverse effects of landfills?

Please draw the layers of the Old Style Landfill.

Homework

On a computer that has access to the internet, please visit <http://www.epa.gov/recyclecity/mainmap.htm>. *Find the landfill within the city. Use the information you gather to answer the following questions.*

1. When Recycle City was called Dumptown, the Old Landfill was used. What was put in the landfill?
2. What happened when poisonous liquids (caused by the trash) seeped into the soil?
3. When Dumptown became Recycle City, how did the government fix the groundwater problem?

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Name:_____

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4. When Recycle City set up the New Landfill, they also set up a Materials Recovery Facility. What does this facility do?

5. Besides the reduction of waste, what is the biggest difference between the Old Landfill and the New Landfill?

6. Please describe each of the five layers in a landfill liner.

7. Is the model landfill that we made in class more like the Recycle City Old Landfill or like the New Landfill?

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Name: _____

Date: _____

8. Which landfill is better for the environment? Why?